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UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT CIRCULAR 373

Washington, D. C.

APRIL, 1926

REVISED ESTIMATES OF CROP ACREAGES, NEW YORK, 1862-1919

A study of methods to be used in revising crop and livestock estimates
of the United States Department of Agriculture

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PART I

INTRODUCTION

Historical studies of the changes in area and production of the crops in the United States contribute to an understanding of the general economic and agricultural development of the country and indicate factors which may influence our future development. The validity of conclusions based on such studies obviously is strengthened if the basic data are comparable throughout the period of years studied and if they are accurate to a high degree.

The records of crop area, production, and yields collected by the Federal Government in the early years of such work were subject to the errors incident to a new project for which methods were developed as the work progressed. Consistent methods were not always used and estimates were not always arrived at in a regular way. The Bureau of Agricultural Economics,¹ therefore, plans a review of the crop records of our principal crops for all States from 1866 to 1919 in order to make corrections and to remove, in so far as possible, causes

¹ The Division of Statistical and Historical Research and the Division of Crop and Livestock Estimates, cooperating.

of misinterpretation, so that the picture in retrospect may be as accurate as possible and so that a reliable foundation may be established as a basis for historical studies.

As an introduction to this project a preliminary study of the records for New York State has been completed. Tests have been made of methods of revision and mathematical formulae for correcting estimates in the decades between the census years have been applied. The acreage estimates for all the principal crops of New York have been revised. To illustrate the methods the revisions are shown step by step.

METHODS

Before presenting the New York State figures as an example of what can be done, a brief explanation is made of the records as now in use and of the proposed methods of revision.

The collection of fragmentary reports on crop conditions and yields per acre was carried on by a small force in the Patent Office irregularly between 1839 and 1862. In 1862 the statistical work relating to agriculture was separated from the Patent Office and placed under a Commissioner of Agriculture. Each season from 1862 to date the acreage and yield of crops in the Northern States and beginning with 1866 for all States have been estimated by the Department of Agriculture.² These estimates have been based upon the latest available reports for the season and have been published in December of each year since 1915. These estimates have been revised one year later.

The estimating of changes in acreage in the various crops from year to year was until recently based almost entirely upon "percentage judgment" reports. The correspondents were asked the question, "How does the acreage in corn, wheat, etc., compare with the acreage a year ago?" The returns when received were averaged. During later years an effort has been made to allow for bias in the returns. In the past 8 or 10 years sample data of actual changes on a large number of individual farms have been used in connection with estimates of acreage changes. The results obtained from the new method seem to indicate that under the old system the reports did not reflect as great changes as actually occurred from year to year.

Since acreages are reported in relation to those of the previous year, it is essential that the basis of the relations frequently be corrected as any constant error cumulates from year to year. Such a correction has been made following each census enumeration since 1910, when the enumeration and estimates were compared and the latter were accepted or adjusted as a basis for the following decade. For the most part no attempt has been made until recently to revise the figures back through the past decades.

The primary purpose which prompted the institution of crop estimates in 1862 and has led to their development to the present has been to see clearly the situation when the estimates were made. Now, however, it is desired to use the series of annual estimates for each State, unbroken through 60 years, in interpreting important changes in our agriculture, and it therefore seems wise to make a revision of the estimates from 1866 to 1919.

² The estimates of production were made by the Division of Statistics from 1862 to 1903; Bureau of Statistics, 1903-1915; Bureau of Crop Estimates, 1915-1921; Bureau of Markets and Crop Estimates, 1921-22; and Bureau of Agricultural Economics, 1922 to date.

About a decade ago the figures between the census of 1900 and that of 1910 were mathematically adjusted to a census base and published for the United States as a whole. Application of uniform method to all the decades, however, may somewhat alter the earlier revision.

Unfortunately, all original work sheets prior to 1895 have been destroyed. The revisions prior to that date must be based upon published data rather than upon a review of original data.

Thus far the problem has been divided and work principally limited to a study of acreage. The dual object of the revision of acreage figures is: (1) To put the figures on a uniform basis from the time of the first complete estimates in 1866 to date, and (2) to have the absolute figures as nearly correct as possible. For both of these purposes the data collected decennially by the census are the best available gauge. The census acreage figures, with certain exceptions for specific reasons, are accepted as the most nearly correct basis from which to work. Further study of the census must be made as the work progresses, but the consequent changes should be slight.

The census of 1880, showing acreage of crops harvested in 1879, was the first to give the acreage of crops. For 1859 and 1869 some basis must be deduced comparable with later acreage enumerations. One indication is the determination of a range within which acreage estimates probably should fall. The limits of the range are ascertained by dividing the census production for the given crop in 1859 and 1869 by the highest and the lowest yields ever reported for that crop by the census. Another indication is the quotient of enumerated production by yield as currently reported to the Bureau of Agricultural Economics. For this purpose the yield figures are modified according to a study of the usual relation between reported and census yields in other census years. Starting early in the decade with the census figure, the estimates during each decade have been link relatives, each being expressed as a fraction or percentage of the previous year's figure. Not all decades begin uniformly in this respect. They vary with the date at which census data became available. The first relative in a decade frequently is considerably different also from others preceding and following, apparently from the desire both to present a satisfactory relationship to the census enumeration and at the same time to show as little irregularity as possible in the series of bureau figures.

For New York, State census data are available for 1854-55, 1864-65, and 1874-75, which proved helpful in establishing acreage figures.

Relation of the trend of the bureau figures to the estimated probable limits of census acreage in 1869 clearly indicates that the estimates were adjusted to that census similarly as to those for which acreage enumerations were made. In a majority of cases the bureau's figure for 1870 stands well within the probable range set up for 1869, establishing a good claim to approximate correctness.

One part of the corrections to be made in all decades is a mathematical one, so adjusting the trend of acreage that the figures on census years will coincide with the census enumerations. This correction must recognize and allow for the link-relative method of arriving at the estimates. The cumulation of errors is geometrical through a decade, and so a correction for the total error in the tenth year, nine-tenths in the ninth year, and so on, is not proper. A formula is used instead, by which the progression of corrections is

geometrical. On a 10-year formula the correction for the ninth year is thus the nine-tenths power of the correction for the tenth year. Similarly there may be a progressive improvement in estimates, giving at the end of a decade a figure more nearly correct than that at the beginning. Here also the progression is geometrical and requires a correction the converse of the former. Both are applied in the formula used as shown below.

When

C = census or corrected figure.

E = estimate by the Department of Agriculture.

N = number of relatives within the period; i. e., number of years (including beginning and ending) less one.

X = year under consideration (x varies from 0 to n).

Then ³

$$C_x = E_x \left(\frac{C_0}{E_0} \right)^{\frac{n-x}{n}} \left(\frac{C_n}{E_n} \right)^{\frac{x}{n}}$$

Or for this particular purpose, when $C_0 = E_0$, then $\left(\frac{C_0}{E_0} \right)^{\frac{n-x}{n}}$ becomes

unity and $C_x = E_x \left(\frac{C_n}{E_n} \right)^{\frac{x}{n}}$

For example, for the year ending with "2" in a period of an exact decade beginning with the year ending in "9" (e. g. for 1882 in a period beginning with 1879 and ending with 1889), the formula becomes

$$C_3 = E_3 \left(\frac{C_0}{E_0} \right)^{\frac{7}{10}} \left(\frac{C_n}{E_n} \right)^{\frac{3}{10}}$$

The formula, of course, may be applied to any one year in question without computing the other years. Periods shorter or longer than a decade may have to be computed by the 10-year formula or a formula may be set up for any other number of years. The method used for more or fewer years must depend upon the particular situation. In correcting more than 10 years on a 10-year formula, the years outside the terminals of the formula ordinarily are at the latter end of the period and are included because census data did not become immediately available. In the formula, then, in the years following the tenth, x becomes greater than n and for the eleventh year on a 10-year base the formula is

$$C_{11} = E_{11} \left(\frac{C_0}{E_0} \right)^{\frac{1}{10}} \left(\frac{C_{10}}{E_{10}} \right)^{\frac{11}{10}}$$

Base years for the formula, of course, must be determined by fixed points which may be accepted as correct, usually census enumerations.

Often the trend of acreage for a given crop is broken within a decade, and in many such cases a formula for less than a 10-year period may be used. It necessitates, however, finding close to the break and on the side for which the formula is sought, a figure sufficiently good to be considered correct in formulating the correction. There may be no noticeable continued trend for more than three or four years

³ See Wright, Sewall, Dept. Bul. 1300, and other treatises on mathematical progression, cumulative errors, etc.

of a decade. Then mathematical corrections, even as described for short periods, are of little avail until the individual years are examined and possibly changed.

If no unusual physical or economic conditions exist to cause undue irregularities, it often must be assumed that the estimate was arrived at in an irregular way, and therefore does not represent a proper relative. In such cases the preliminary estimates of acreage planted as published in the summer usually give the most satisfactory figure with which to start. These preliminary figures are published in the reports for June, July, and August of each year. Their use assumes that the method of link relatives, while forming the basis of the estimating system, has not always determined the final figures. Study of the data has justified such an assumption, and there are no sufficient records to refute it. An extreme illustration of this irregularity of estimates is the series for hay acreage in Kansas for three decades beginning in 1879 (fig. 1). From 1882 to 1883 it shows an increase

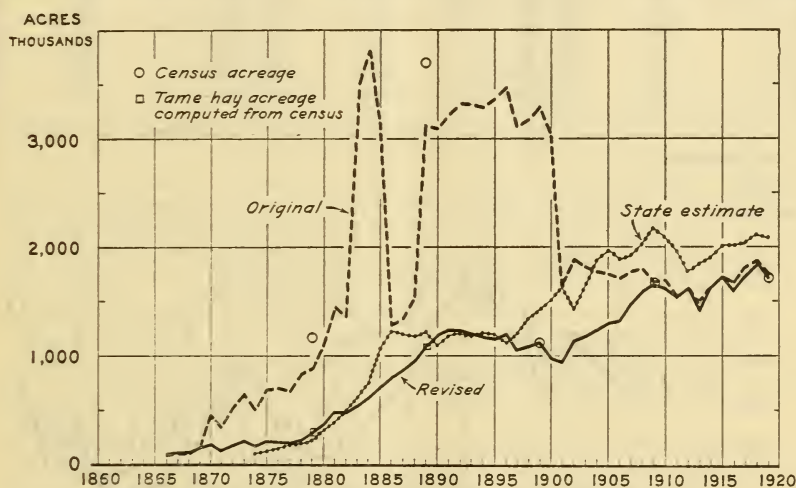


FIG. 1.—Hay acreage, Kansas, original and revised estimates, 1866-1919

of 150 per cent, from 1885 and 1886 it drops 60 per cent, and from 1888 it jumps 150 per cent to the census enumeration of 1889. From 1889 it may be said to have a trend till 1900, from which point it drops 50 per cent to 1901. Preceding 1883 the basis of the Kansas hay figures still is uncertain; 1883, 1884, and 1885 are for total hay; 1886, 1887, and 1888 are for tame hay; 1889 to 1900 are for total; and 1901 is for tame. Previous to 1889 an analysis and revision of these estimates must be made largely from a general study of the situation.

Following for the most part the methods here described, the acreage estimates for New York have been revised, and to illustrate the work the revisions are given step by step below. In so far as possible these same methods will be used in revising the acreages for other States. They will be modified freely, however, in any way dictated by further study or by suggestion and criticism which the bureau may receive from others interested in the work.

PART II

REVISION OF THE ACREAGE ESTIMATES FOR NEW YORK ⁴

TABLE 1.—Harvested wheat acreage in New York, original and revised estimates, 1862–1919

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>
1862	723	546	1882	772	712	1901	598	598
1863	930	601	1883	780	694	1902	478	456
1864	840	542	1884	772	663	1903	544	496
1865	837	542	1885	687	569	1904	475	413
1866	826	537	1886	680	543	1905	491	407
1867	569	569	1887	667	515	1906	468	370
1868	582	582	1888	660	490	1907	416	314
1869	609	609	1889	647	463	1908	443	319
1870	662	662	1890	641	443	1909	420	289
1871	558	657	1891	641	426	1910	355	302
1872	537	622	1892	519	381	1911	345	291
1873	522	595	1893	472	383	1912	335	279
1874	587	656	1894	426	381	1913	340	318
1875	650	715	1895	403	399	1914	360	334
1876	650	703	1896	397	456	1915	475	436
1877	711	756	1897	345	438	1916	400	363
1878	744	779	1898	379	518	1917	420	378
1879	716	737	1899	379	568	1918	430	383
1880	788	782	1900	367	582	1919	464	463
1881	780	746						

Census figures italic.

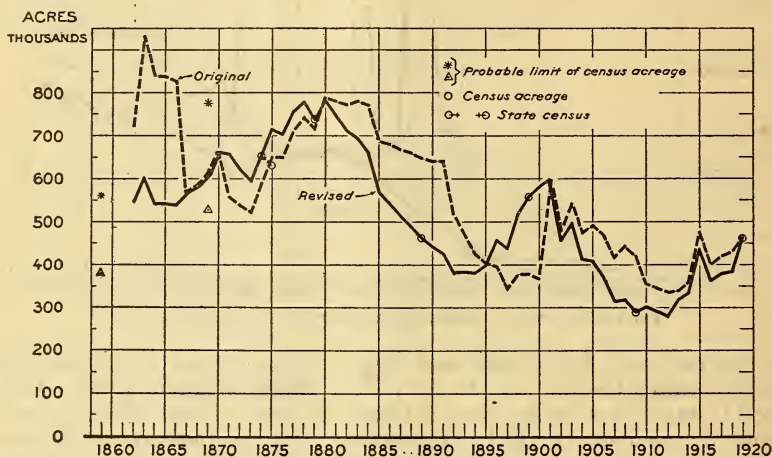


FIG. 2.—Harvested wheat acreage, New York, original and revised estimates, 1862–1919

WHEAT

(Table 1, fig. 2)

The 1867, 1868, 1869, and 1870 figures for wheat are accepted as correct because the 1869 figure falls well within the probable limits set up, and because apparently no readjustment was found necessary between 1866 and 1867 as shown does not seem correct, as it appears to have no physical reason. A figure for 1866 is obtained, therefore, by applying to the 1867 estimate the inverse of the preliminary estimate of the ratio of 1867 to 1866.

⁴ The study as a whole is concerned with the period from 1866 to 1919; the tables and graphs for New York have been carried back to 1862 for comparison.

For 1871 also the preliminary estimate is substituted. This changes the estimates in later years, making it necessary to compute new figures for the remainder of the decade on the basis of the relatives. This is an intermediate computation made necessary by the use of preliminary estimates. The eight figures lying between 1870 and 1879 then are corrected by formula making a zero change at 1870 and a decrease to the census in 1879. For this correction $\frac{C_0}{E_0}$ equals 1, and as noted above the formula becomes

$$C_x = E_x \cdot 1 \left(\frac{C_n}{E_n} \right)^{\frac{x}{n}} \quad \text{or} \quad C_x = E_x \left(\frac{C_n}{E_n} \right)^{\frac{x}{n}}$$

The year 1871 must be included in the correction because it is assumed that the error in trend which leads to variance from the census in 1879 affects preliminary as well as final estimates. The appearance of the graph of acreage might lead to the thought that the curve of revised estimates lies too high, dropping as it does to the census of 1879 and rising again in 1880. Related facts, though, justify such a drop in 1879.

The relative of the final estimate for 1880 is used to obtain an 1880 figure correct as an estimate in relation to the census of 1879. Although the estimate had been made in relation to the estimate for 1879, it apparently was abandoned when the 1879 estimate and census enumeration were found at variance. The years between 1879 and 1892 are corrected on a 10-year (1879-1889) formula, new estimates first having been substituted temporarily as in the previous decade. The substitute estimates can not stop with 1889, but must include 1890 and 1891, as the new census data had not become available and estimates still were on an 1879 basis.

The 1891 figure now having been corrected, the years 1892 to 1900 inclusive are corrected by an eight-year formula based on 1891 and 1899, by which the 1891 figure is changed as indicated and 1899 is brought to the census.

The decade from 1899 to 1909 may be treated in either of two ways. Census data for 1899 became available between the time of the estimates of 1900 and 1901, and the relations between 1900 and 1901 figures for perhaps a majority of crops in most States are widely at variance from the trends before or after. In adjusting this difference the 1901 figure may be accepted as in correct relationship to the enumeration of 1899, and, therefore, dependable; or the preliminary estimated ratio of 1901 to 1900 may be accepted as approximately correct, and the figure changed on that basis. When the two methods give figures comparatively close together, the departure from the preliminary estimate is considered reasonable and the final estimate is accepted; this is done for wheat. Accepting 1901 as it stands, correction is made by a "three-point" formula based on 1901 and 1909. (When the figure at neither terminal of the formula agrees with the census there are four points on which to base the formula, two correct and two uncorrected figures; when a correction is made only at one end of a decade there are but three points, one correct and one uncorrected figure coinciding. "Three-point" and "four-point" are here used to designate which correction is made.) The bureau apparently adjusted its 1909 revised estimates on the basis of the census. No record of the basis of the adjustment is extant, however, and so here the December 1909 estimates are used.

From 1911 to 1919, or for wheat from 1912 to 1919, the estimates were based on preliminary census figures for 1909. The records for each crop must be examined to find if any change was made from preliminary to final census acreage. After such examination revision for the decade is made on a 1909-1919, three-point formula, correcting 1919.

TABLE 2.—Harvested corn acreage in New York, original and revised estimates 1862-1919

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	1,000 acres	1,000 acres		1,000 acres	1,000 acres		1,000 acres	1,000 acres
1862.....	688	452	1882.....	769	692	1901.....	626	616
1863.....	729	483	1883.....	761	662	1902.....	645	616
1864.....	772	511	1884.....	754	633	1903.....	619	574
1865.....	1,056	562	1885.....	731	593	1904.....	626	573
1866.....	845	562	1886.....	717	561	1905.....	613	537
1867.....	641	506	1887.....	709	536	1906.....	650	553
1868.....	653	518	1888.....	706	516	1907.....	600	496
1869.....	705	560	1889.....	699	493	1908.....	625	502
1870.....	571	571	1890.....	643	469	1909.....	512	512
1871.....	530	556	1891.....	694	523	1910.....	525	523
1872.....	513	564	1892.....	528	513	1911.....	530	507
1873.....	571	558	1893.....	517	519	1912.....	512	508
1874.....	560	677	1894.....	491	511	1913.....	527	521
1875.....	581	737	1895.....	506	543	1914.....	550	542
1876.....	700	695	1896.....	526	583	1915.....	605	595
1877.....	709	730	1897.....	495	566	1916.....	700	686
1878.....	695	750	1898.....	475	562	1917.....	820	801
1879.....	688	779	1899.....	503	659	1918.....	800	780
1880.....	802	774	1900.....	539	681	1919.....	762	762
1881.....	762	711						

Census figures italic.

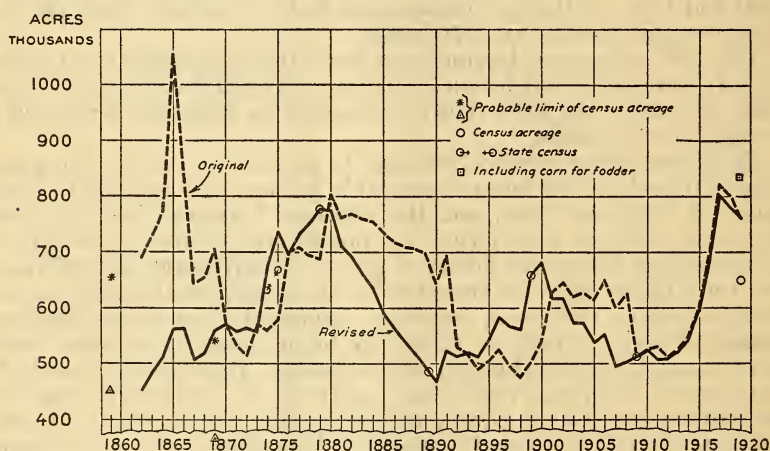


FIG. 3.—Harvested corn acreage, New York, original and revised estimates, 1862-1919

CORN

(Table 2, fig. 3)

With corn, as with wheat, the 1870 figure is assumed correct. There had been an adjustment from 1869, apparently on the basis of the census. Linking 1870 back to 1869 by the preliminary estimate for 1870 throws the 1869 acreage close to the probable limits set up, and on the more reasonable side of these limits. Census production divided by estimated yield gives an acreage farther out, and in the

same direction as the one here obtained. Using preliminary estimate relatives for 1867 and 1870, new estimates are worked for years preceding 1870. For 1876 also the preliminary figure is used and new estimates computed to 1879. A three-point formula 1870-1879 then is used to correct the intervening years.

There is no logical connection between the original estimate for 1879 and that for 1880, and so the correction for the former year has no importance for the following decade. Any changes made in this decade, therefore, must rest upon the census enumeration for 1879 and 1889 and the original estimate for 1889. The original estimate is used also for 1880, however, and by the method described above, intermediate figures would have to be computed for the remaining years of the decade. To make this computation unnecessary the three-point formula is used only to revise the preliminary estimate for 1880; the formula then is scrapped. A four-point formula is set up for 1880 and 1889, changing for 1880 the final estimate to the corrected preliminary estimate, correcting the 1889 estimate to the census, as before, and including 1890 and 1891. Whether this or the former method should be used in a given case depends upon the place in the decade where the break comes, and upon the consequent work involved. The period 1892 to 1900 is corrected by the use of the preliminary estimate for 1892 and the census of 1899. The estimate for 1892 is corrected by a three-point formula for 1891 and 1899; and a four-point, seven-year formula for 1892 and 1899 is set up and applied to the years 1892-1900.

Preliminary estimates are used for 1901 and 1909. The 1901 figure is handled as 1892 has been, and the decade similarly corrected by a four-point, eight-year formula for 1901 and 1909. Correction from 1909 to 1919 is by a three-point formula based on the preliminary estimate for 1919 and on a 1919 estimate revised on the basis of the census. This revised estimate for 1919 is rather widely at variance from the census enumeration, but because of the increasing production of corn for silage and fodder and the consequent gradual change in classification it seems the advisable figure to use.

TABLE 3.—*Harvested oats acreage in New York, original and revised estimates, 1862-1919*

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>
1862.....	1,256	1,108	1882.....	1,338	1,328	1902.....	1,325	1,322
1863.....	1,570	1,209	1883.....	1,345	1,341	1903.....	1,311	1,306
1864.....	1,553	1,207	1884.....	1,372	1,374	1904.....	1,246	1,238
1865.....	1,534	1,195	1885.....	1,385	1,393	1905.....	1,258	1,247
1866.....	1,637	1,275	1886.....	1,399	1,414	1906.....	1,246	1,233
1867.....	1,450	1,173	1887.....	1,413	1,435	1907.....	1,208	1,193
1868.....	962	1,244	1888.....	1,399	1,427	1908.....	1,250	1,232
1869.....	893	1,244	1889.....	1,385	1,419	1909.....	¹ 1,303	1,303
1870.....	915	1,269	1890.....	1,343	1,359	1910.....	1,320	1,295
1871.....	834	1,293	1891.....	1,330	1,330	1911.....	1,310	1,261
1872.....	894	1,293	1892.....	1,383	1,367	1912.....	1,192	1,226
1873.....	889	1,293	1893.....	1,259	1,229	1913.....	1,275	1,181
1874.....	924	1,293	1894.....	1,372	1,323	1914.....	1,275	1,159
1875.....	1,141	1,358	1895.....	1,441	1,373	1915.....	1,340	1,195
1876.....	1,407	1,317	1896.....	1,513	1,424	1916.....	1,206	1,055
1877.....	1,371	1,344	1897.....	1,482	1,378	1917.....	1,200	1,030
1878.....	1,400	1,371	1898.....	1,408	1,294	1918.....	1,260	1,061
1879.....	1,288	<i>1,267</i>	1899.....	1,465	<i>1,350</i>	1919.....	1,220	1,003
1880.....	1,312	1,290	1900.....	1,596	1,435			
1881.....	1,325	1,309	1901.....	1,299	1,299			

figures in italics.

¹ December estimate was 1,325, later revised.

OATS

(Table 3, fig. 4)

The 1870 acreage figure for oats can not be assumed to bear any significant relation to the probable limits of acreage in 1869. Apparently the 1870 figure is not correct and was not adjusted as was the corn figure. From 1868 through 1874 the trend seems reasonable, but lies entirely too low in comparison with earlier and later years. Census figures show about the same production of oats in 1859, 1869, and 1879, a story with which the annual estimates entirely fail to agree.

The relatives which throw the trend badly out of line are for 1868, 1875, and 1876. For these years, therefore, preliminary estimates are used. Then by use of the relatives the line is run back from 1879 to the beginning. The relative for 1879 invites investigation, but so far the evidence upholds it.

Judging from relation to census figures, the estimates from 1880 to 1890 were excellent. The slight correction to the census is made with

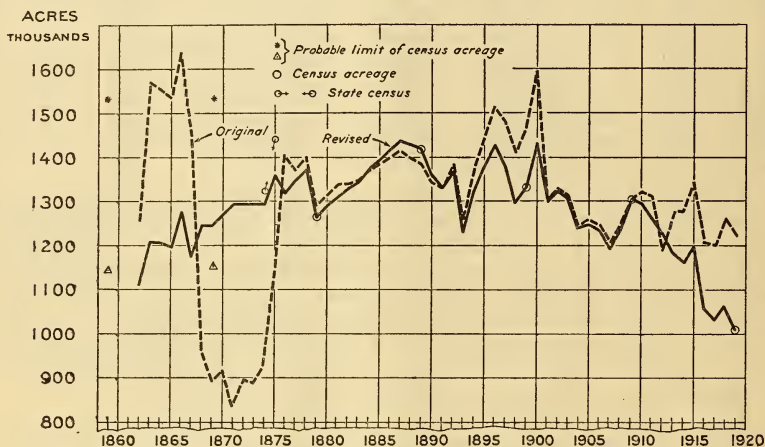


FIG. 4.—Harvested oats acreage, New York, original and revised estimates, 1862-1919

a four-point formula. It seems entirely probable that the wide dispersion during the nineties as compared with the eighties is due to a change in policy in estimating. There has appeared no way intelligently to amplify the fluctuation in the one decade or decrease it in the other. The mathematical possibility of equalizing the amplitudes for the two decades is not denied, but its legitimacy is questioned. That the estimates during the nineties were considerably biased and were not corrected for this bias is indicated by the discrepancy between the estimate and census figure in 1899. All the years between 1891 or 1892 and 1902 need further historical study to justify or to change the figures as here revised. A four-point formula for 1889 and 1899 is used for the only correction made in the years between 1889 and 1901.

The years between 1901 and 1910 were corrected by both methods, by that of accepting the 1901 figure and by relating 1901 to 1900 by the preliminary estimate relative. To accept 1901 as correct seems the more reasonable and is here finally followed. Correction is then

based on an eight-year, three-point formula 1901 and 1909, making no correction in 1901.

A three-point formula for 1909 and 1919 is used to correct the estimate for 1919 (1,220,000 acres) to 1,008,000, the previous final figure of the bureau as adjusted by use of the census.

TABLE 4.—Harvested barley acreage in New York, original and revised estimates, 1862–1919

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>
1862.....	168	334	1882.....	359	359	1902.....	118	90
1863.....	233	367	1883.....	358	358	1903.....	110	88
1864.....	198	344	1884.....	354	354	1904.....	98	81
1865.....	192	334	1885.....	340	340	1905.....	91	78
1866.....	190	331	1886.....	351	351	1906.....	86	77
1867.....	194	328	1887.....	340	340	1907.....	79	73
1868.....	179	312	1888.....	343	343	1908.....	77	74
1869.....	191	321	1889.....	349	349	1909.....	80	80
1870.....	312	312	1890.....	314	301	1910.....	81	86
1871.....	268	280	1891.....	321	296	1911.....	80	89
1872.....	278	303	1892.....	311	275	1912.....	82	97
1873.....	277	316	1893.....	271	230	1913.....	77	96
1874.....	298	355	1894.....	260	212	1914.....	75	99
1875.....	433	342	1895.....	239	187	1915.....	85	119
1876.....	300	379	1896.....	213	160	1916.....	90	133
1877.....	270	356	1897.....	191	137	1917.....	110	172
1878.....	259	357	1898.....	172	119	1918.....	125	206
1879.....	248	357	1899.....	169	112	1919.....	171	171
1880.....	352	352	1900.....	171	109			
1881.....	356	356	1901.....	120	102			

Census figures italic.

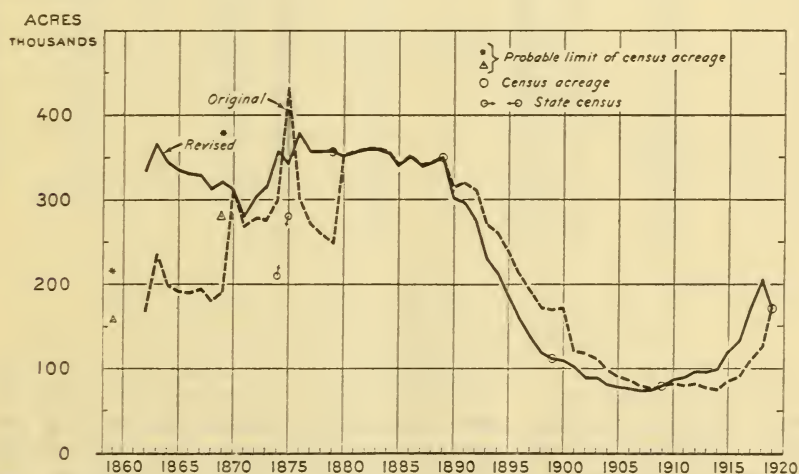


FIG. 5.—Harvested barley acreage, New York, original and revised estimates, 1862–1919

BARLEY

(Table 4, fig. 5)

Relationships between estimates of 1869 and 1870 and between them and the probable range for census acreage in 1869 shows clearly that the 1870 figure was adjusted to the census. The 1870 estimate is accepted, therefore, and earlier years are reworked on the preliminary estimate for 1870.

In 1875 the final estimate is nearly 25 per cent above the previous year. Such a percentage increase is extreme, and coupled with a

preliminary estimate of 92 per cent of the previous year's acreage and with the fact that it dropped back to about its former level in 1876, looks doubtful. Here the preliminary figure is used, though 1875 should receive further study. After the years following 1875 are adjusted by this change, the decade is corrected with a nine-year, three-point formula on 1870 and 1879.

The decade of the eighties requires no revision.

From 1889 through 1900 a 10-year, three-point formula on 1889 and 1899 is used, bringing the acreage in the latter year to the census. For barley it is questionable if the 1901 absolute figure is as good as the preliminary estimate related to the 1900 corrected figure. The latter is used, and the decade corrected by an eight-year, four-point formula on 1901 and 1909, correcting to the new 1901 figure and the 1909 census.

A three-point formula is used for the 1909-1919 decade, bringing the 1919 December estimate to the final estimate.

TABLE 5.—*Harvested rye acreage in New York, original and revised estimates, 1862-1919*

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>
1862.....	283	385	1882.....	239	239	1902.....	165	163
1863.....	385	385	1883.....	242	242	1903.....	158	155
1864.....	359	359	1884.....	239	239	1904.....	147	143
1865.....	354	354	1885.....	242	242	1905.....	135	131
1866.....	326	326	1886.....	237	237	1906.....	138	133
1867.....	340	341	1887.....	235	235	1907.....	128	122
1868.....	321	322	1888.....	237	237	1908.....	145	137
1869.....	327	328	1889.....	237	237	1909.....	131	131
1870.....	172	318	1890.....	235	229	1910.....	140	137
1871.....	141	318	1891.....	232	221	1911.....	135	129
1872.....	139	314	1892.....	232	215	1912.....	128	119
1873.....	132	298	1893.....	230	208	1913.....	133	121
1874.....	130	293	1894.....	234	207	1914.....	129	115
1875.....	245	281	1895.....	239	206	1915.....	150	130
1876.....	230	264	1896.....	244	205	1916.....	125	106
1877.....	220	252	1897.....	241	198	1917.....	125	108
1878.....	222	255	1898.....	229	183	1918.....	112	91
1879.....	213	245	1899.....	227	177	1919.....	95	95
1880.....	230	230	1900.....	211	161			
1881.....	235	235	1901.....	163	163			

Census figures italic.

RYE

(Table 5, fig. 6)

Rye acreage prior to 1879 is obtained by working backward with the estimate relatives. For 1870 to 1875 preliminary estimates are used. The shape of the curve from 1866 to 1869, 1870 to 1874, and 1875 to 1879 makes this appear proper. Likewise this revision gives substantial agreement between original and revised figures from 1863 to 1869. Comparison with wheat acreage further substantiates it; wheat gradually was substituted for rye.

Estimates during the eighties are accepted as they stand. From 1889 through 1900 correction is made by a three-point formula bringing the 1899 estimate to the census.

The next decade is revised by an eight-year, three-point formula, using the absolute figure for 1901 and adjusting the preliminary 1909 estimate to the census.

Years between 1909 and 1919 are corrected by a three-point formula bringing the 1919 December estimate to the final estimate.

TABLE 6.—Harvested buckwheat acreage in New York, original and revised estimates, 1862–1919

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>
1862.....	271	240	1882.....	285	274	1902.....	335	294
1863.....	336	240	1883.....	291	276	1903.....	338	297
1864.....	313	224	1884.....	308	288	1904.....	342	300
1865.....	308	220	1885.....	311	287	1905.....	331	291
1866.....	247	211	1886.....	318	290	1906.....	322	283
1867.....	327	235	1887.....	318	286	1907.....	325	286
1868.....	299	227	1888.....	311	276	1908.....	319	280
1869.....	278	211	1889.....	280	280	1909.....	286	286
1870.....	192	192	1890.....	288	293	1910.....	280	278
1871.....	128	193	1891.....	291	302	1911.....	280	276
1872.....	150	232	1892.....	285	301	1912.....	277	271
1873.....	150	238	1893.....	285	306	1913.....	280	273
1874.....	162	264	1894.....	291	319	1914.....	274	265
1875.....	234	274	1895.....	280	312	1915.....	260	251
1876.....	268	279	1896.....	266	302	1916.....	275	262
1877.....	271	290	1897.....	258	298	1917.....	315	299
1878.....	268	294	1898.....	242	285	1918.....	315	297
1879.....	258	291	1899.....	242	290	1919.....	218	218
1880.....	285	281	1900.....	234	285			
1881.....	280	273	1901.....	338	297			

Census figures italic.

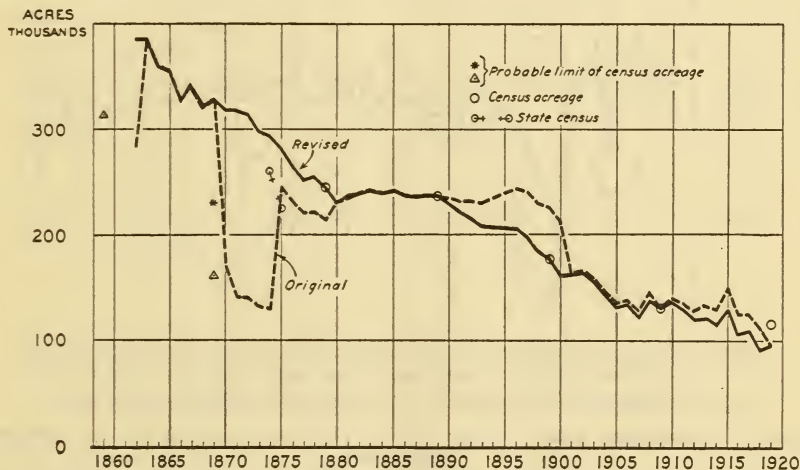


FIG. 6.—Harvested rye acreage, New York, original and revised estimates, 1862–1919. NOTE.—The upper probable limit of census acreage for 1859 is 444,000 acres

BUCKWHEAT (Table 6, fig. 7)

The 1870 estimate for buckwheat stands. Earlier years are worked back by the preliminary estimate relatives for 1870 and 1867. With the preliminary estimates for 1871, 1875, and 1876 the decade of the seventies is reworked; and the decade is revised by a three-point formula, raising 1879 to the census.

A correct 1880 figure is obtained by the preliminary relative for 1880 related to the census figure of 1879; the line then is revised by a four-point formula changing the original 1880 figure to the newly computed one and lowering the preliminary estimate for 1889 to the census. A three-point formula based on 1889 and 1899 and bringing 1899 to the census is used to correct 1890 through 1900.

Preliminary estimate relatives are used to relate 1901 to the corrected 1900 figure and to relate 1909 to 1908. The 1901 estimate just obtained is further corrected by a three-point formula based on the

corrected 1900 estimate, the preliminary 1909 estimate and the 1909 census figure. For all practical purposes this last step might be omitted though its omission is theoretically incorrect. To be strictly correct, the 1901 estimate dependent upon the preliminary estimate and the 1900 figure must receive an adjustment equal to the ninth root of the correction in 1909; in certain cases the difference is important. These preparatory changes having been made, the decade is revised by a four-point, eight-year formula on the 1901 change noted above and on the 1909 estimate.

The year 1919 is corrected from the December to the final estimate by a three-point formula revising the previous decade.

In New York, as elsewhere where buckwheat is grown on any important area, it is sown on the ground where wet weather, a late spring, low price, or some other unfavorable circumstance has prevented the sowing of an earlier grain. One must not expect, therefore, that it will fluctuate in exactly the same way as the major grain crops.

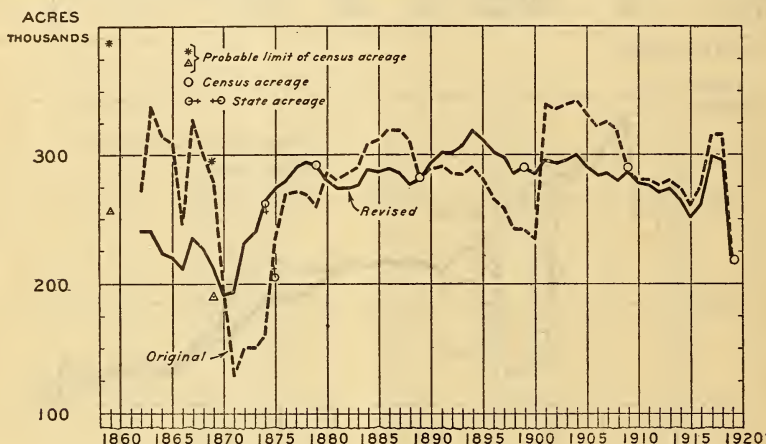


FIG. 7.—Harvested buckwheat acreage, New York, original and revised estimates, 1862-1919

TABLE 7.—Harvested potato acreage in New York, original and revised estimates, 1862-1919

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>		<i>1,000 acres</i>	<i>1,000 acres</i>
1862	264	264	1882	382	359	1902	407	398
1863	354	358	1883	401	379	1903	395	381
1864	258	258	1884	361	343	1904	442	422
1865	283	283	1885	357	342	1905	429	405
1866	291	291	1886	350	337	1906	420	391
1867	297	297	1887	353	346	1907	426	392
1868	270	270	1888	371	366	1908	425	387
1869	250	250	1889	361	357	1909	594	594
1870	256	256	1890	350	353	1910	395	395
1871	247	258	1891	361	372	1911	375	375
1872	270	294	1892	339	357	1912	360	360
1873	242	275	1893	357	384	1913	360	360
1874	242	287	1894	379	416	1914	367	367
1875	327	329	1895	424	476	1915	355	355
1876	418	292	1896	386	443	1916	320	320
1877	374	301	1897	340	398	1917	400	400
1878	356	300	1898	333	398	1918	380	380
1879	369	341	1899	326	396	1919	310	310
1880	362	337	1900	339	421			
1881	353	330	1901	384	379			

Census figures italics.

POTATOES

(Table 7, fig. 8)

The two features attracting attention in the revision of the potato acreage are the method of finding the 1870 figure and the correction of preliminary estimates to the census for all years from 1869 to 1909. The preliminary estimates reported before harvest, each as a relative of the preceding year, were linked together and the trend brought to the census by the formula described above. The results agreed in general with the revision of final estimates and are not shown in the table or graph. Use of preliminary estimates in this way is advisable only for experiment.

To obtain the 1869 figure the percentage difference is taken between estimated and census yields for each census year 1879-1919. Average excess of census over estimated yield is added to the estimated yield for 1869. Census production for 1869 is then divided by this computed yield. Average potato yield for New York as esti-

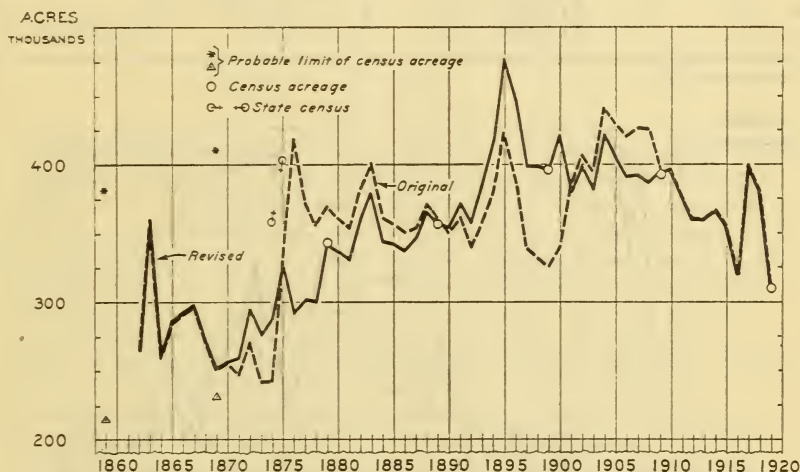


FIG. 8.—Harvested potato acreage, New York, original and revised estimates, 1862-1919

imated by the bureau for census years is 95 per cent of the average of yields reported by the census. The estimate for 1869 was 114 bushels, giving a computed census yield of 120. Dividing the 1869 census production by 120 gives 238,000 for acreage. It happens in this case, however, that to divide by 114, the uncorrected estimate, gives 250,000, exactly the original acreage estimate. This leads to the suspicion that this was the method used in obtaining the estimate. As long as the general picture is not seriously altered by interchange of the figures, the estimate extant is used here. The major value of the additional experimentation with potatoes as in several cases has been, it happens, to justify in general the acceptance of the 1870 figure.

Preliminary estimates are used to obtain ratios for 1875, 1876, and 1877, and the decade is reworked; a three-point formula is applied, correcting 1879 to the census.

On the next two decades four-point formulae are used, and with the latter 1900 is included.

The preliminary estimate is used for 1909 and the decade from 1900 to 1909 is revised by a three-point formula.

TABLE 8.—*Harvested tobacco acreage in New York, original and revised estimates, 1862-1919*

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	1,000 acres	1,000 acres		1,000 acres	1,000 acres		1,000 acres	1,000 acres
1862	6	1.6	1882	8	7.4	1902	8	7.2
1863	9	2.3	1883	5	7.4	1903	8	6.9
1864	15	3.0	1884	5	7.3	1904	5	4.2
1865	11	2.2	1885	7	7.4	1905	6	4.8
1866	14	2.8	1886	6	6.8	1906	7	5.6
1867	16	2.5	1887	6	7.3	1907	7	5.3
1868	15	2.4	1888	6	8.4	1908	6	4.4
1869	11	2.2	1889	9	9.0	1909	4	4.0
1870	2	2.0	1890	9	9.8	1910	4	4.0
1871	4	4.4	1891	9	10.6	1911	4	4.0
1872	3	3.7	1892	9	11.5	1912	4	4.0
1873	3	4.1	1893	8	11.2	1913	4	4.0
1874	2	3.0	1894	6	9.1	1914	5	5.0
1875	3	5.0	1895	4	6.6	1915	4	4.0
1876	2	3.7	1896	3	5.4	1916	4	4.0
1877			1897	4	7.8	1917	2	2.0
1878	2	4.5	1898	4	8.4	1918	3	3.0
1879	2	5.0	1899	11	11.0	1919	3	3.0
1880	5	5.6	1900	9	8.7			
1881	5	6.0	1901	9	8.4			

Census figures italic.

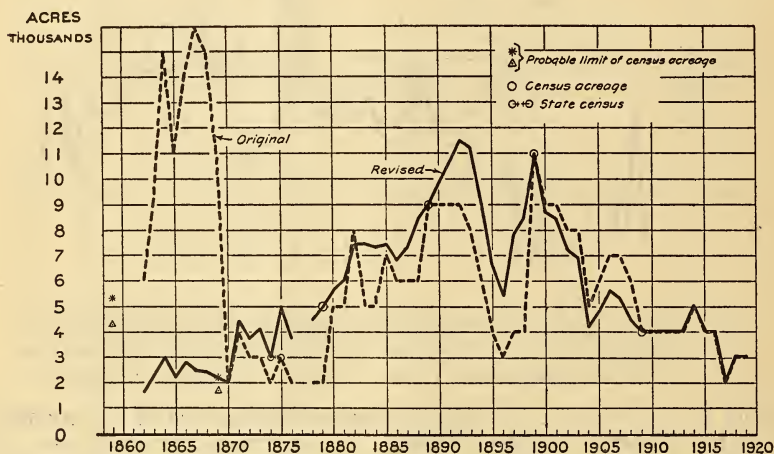


FIG. 9.—Harvested tobacco acreage, New York, original and revised estimates, 1862-1919

TOBACCO

(Table 8, fig. 9)

The 1870 figure is accepted for tobacco. The year 1879 is raised to the census, affecting by three-point formulae the decades at both sides of it. Preliminary estimates are used for 1899 and 1909, and each is used in a three-point formula to revise the preceding decade. From 1909 to 1919 no change is made.

TABLE 9.—Harvested hay acreage in New York, original and revised estimates, 1862–1919

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	1,000 acres	1,000 acres		1,000 acres	1,000 acres		1,000 acres	1,000 acres
1862	3,183	2,828	1882	4,962	4,962	1901	5,065	5,065
1863	3,557	3,177	1883	4,962	4,962	1902	5,014	5,008
1864	3,548	3,177	1884	4,962	4,962	1903	4,813	4,796
1865	2,777	3,380	1885	4,962	4,962	1904	4,765	4,749
1866	3,966	3,558	1886	5,111	5,111	1905	4,718	4,696
1867	4,442	3,998	1887	5,060	5,060	1906	4,718	4,691
1868	4,500	4,051	1888	4,933	4,933	1907	4,717	4,685
1869	2,987	4,010	1889	5,243	5,243	1908	4,764	4,726
1870	3,651	3,949	1890	6,066	5,438	1909	¹ 4,721	4,721
1871	3,460	3,600	1891	6,006	5,422	1910	4,780	4,794
1872	3,613	3,777	1892	6,006	5,460	1911	4,720	4,748
1873	4,117	4,023	1893	5,886	5,388	1912	4,720	4,762
1874	4,071	3,904	1894	5,297	5,319	1913	4,700	4,756
1875	4,188	3,948	1895	4,873	5,249	1914	4,653	4,722
1876	4,870	4,498	1896	4,240	4,704	1915	4,225	4,688
1877	4,375	3,976	1897	4,452	4,974	1916	4,350	4,843
1878	4,800	4,279	1898	4,585	5,159	1917	4,332	4,833
1879	4,644	4,644	1899	4,939	4,939	1918	4,300	4,811
1880	4,854	4,854	1900	4,138	4,722	1919	² 4,922	4,922
1881	4,913	4,913						

Census figures italic.

¹ December estimate was 4,764.

² December estimate was 4,386.

HAY

(Table 9, fig. 10)

The 1870 figure for hay as for potatoes is obtained by dividing the production which the census reported by a computed yield. To compute the yield the average differential was found between yields reported by the census and estimated yields in census years. The 1869 estimated yield then was adjusted by this average differential. Obtained in that way or accepted as it stands, it will not give an 1869 figure within the probable limits. These limits, however, are to be questioned in this case. That year saw a very heavy yield of hay and perhaps the lower limit of the range should be extended downward. In obtaining the limits, census production for 1869 is divided by the highest and lowest yield ever reported by the census. With accurate enumeration of production this gives the limits of acreage for any yield not greater or less than ever reported. If, however, the yield in 1869 was greater than the census ever reported, the 1869 acreage should constitute the lower limit, at some point below the probable range as now shown. Furthermore, the general position of the range, as compared with a similar one for 1859 and with acreage enumerated in 1879, appears too high. There is no apparent reason to expect trend of hay acreage to follow the path thus indicated. Whether to assume 1870 correct or to assume that as with oats no adjustment was made still is a question.

In the Western States the census of hay production for 1859 and 1869 includes wild hay. Analysis of the returns for more States may show whether the same is consistently true in the East. Since the Civil War wild hay production has been of comparatively little importance in New York, and it would seem satisfactory to accept the census figures as applying to tame hay.

During the early years of the bureau record the only preliminary estimates available are for clover. Much may be said against use of them as an index of total hay, yet for New York it seems that changes in clover acreage may be an acceptable index of changes in hay acreage. Being the best available indicator, they are used. Preliminary

figures are accepted for 1871, 1872, and 1873, and the decade is then corrected to the census of 1879 by a three-point formula.¹ No change is made from 1879 to 1889. For 1890, 1894, 1895, and 1896 preliminary estimates are used, the decade reworked, and then corrected by a three-point formula bringing 1899 to the census. The year 1900 is included with the previous decade and for 1901 the figure is accepted as it stands. A three-point formula is based on 1901 and 1909, bringing the 1909 estimate to the census.

For 1919 the final estimate by the bureau is approximately 4,400,000 acres of hay, whereas the census enumeration gives over 4,900,000. The difference is significant. The census figure for hay compared with bureau figures for other crops would indicate that although the main crops, hay excluded, had practically the same acreage as in 1909, hay had increased by over 200,000 acres in response to high

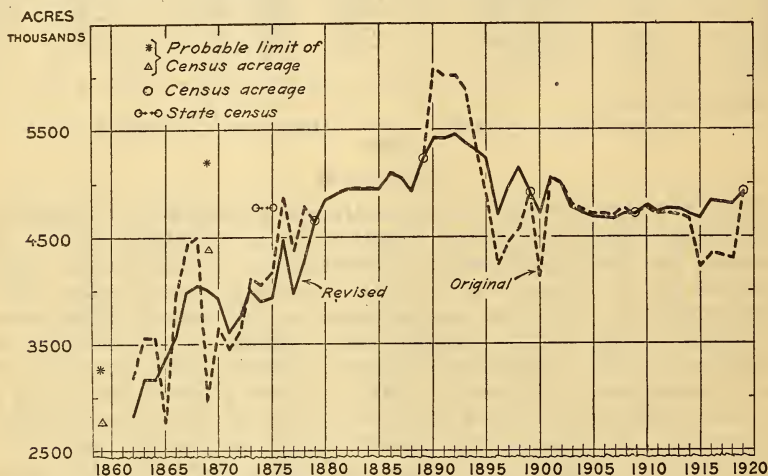


FIG. 10.—Harvested hay acreage, New York, original and revised estimates, 1862-1919

prices and favorable competition with the West. This does not mean an increase in hay at the expense of corn and wheat, as the charts for these crops show; but a rather general expansion following the beginning of the European war in 1914. The lower figure, with a decreased acreage would mean a relative shift away from a crop in which New York is favorably situated, to others in which the State has difficulty in competing with the West. General observation and the historical development of the State favor the higher figure. The shape of the line of hay acreage from 1909 to 1919, and the census figures for these years indicate the same dislocation of the line by one misleading estimate, as has appeared frequently in crop records of the earlier years.

Apparently the difficulty in this case came from the conjunction of an error in the estimate of 1915 with one in a school census of the State in 1917. The school census, being reasonably accurate for other crops, was assumed to be so for hay. Both census and 1915 estimate showing very low hay acreage compared with years prior to 1915, the presumption was that they approximated the facts.

¹ Further consideration is needed to reconcile the State censuses of 1864-65 and 1874-75 with the trend shown by the Federal censuses of 1879 and 1889.

Here the preliminary estimate for 1915 is used, the remaining years are reworked, and the decade corrected by a three-point formula for 1909 and 1919, bringing the adjusted 1919 figure to the census.

TABLE 10.—*Harvested acreage of wheat, corn, oats, barley, rye, buckwheat, potatoes, tobacco, and hay, original and revised estimates in New York, 1862–1919*

Year	Original	Revised	Year	Original	Revised	Year	Original	Revised
	1,000 acres	1,000 acres		1,000 acres	1,000 acres		1,000 acres	1,000 acres
1862.....	6,844	6,159	1882.....	9,114	8,932	1901.....	8,602	8,526
1863.....	8,103	6,828	1883.....	9,145	8,921	1902.....	8,495	8,354
1864.....	7,856	6,625	1884.....	9,127	8,863	1903.....	8,296	8,100
1865.....	7,352	6,872	1885.....	9,022	8,735	1904.....	8,146	7,923
1866.....	8,342	7,150	1886.....	9,169	8,851	1905.....	8,072	7,797
1867.....	8,276	7,449	1887.....	9,101	8,732	1906.....	8,055	7,454
1868.....	7,781	7,528	1888.....	8,966	8,596	1907.....	7,916	7,566
1869.....	6,251	7,535	1889.....	9,210	8,850	1908.....	8,054	7,661
1870.....	6,733	7,531	1890.....	9,889	8,895	1909.....	7,717	7,720
1871.....	6,170	7,159	1891.....	9,885	8,903	1910.....	7,880	7,814
1872.....	6,397	7,403	1892.....	9,612	8,881	1911.....	7,779	7,680
1873.....	6,903	7,600	1893.....	9,285	8,658	1912.....	7,610	7,626
1874.....	6,976	7,732	1894.....	8,756	8,697	1913.....	7,696	7,630
1875.....	7,802	7,989	1895.....	8,409	8,752	1914.....	7,688	7,608
1876.....	8,845	8,431	1896.....	7,788	8,282	1915.....	7,499	7,773
1877.....	8,301	8,005	1897.....	7,808	8,395	1916.....	7,470	7,772
1878.....	8,746	8,359	1898.....	7,527	8,526	1917.....	7,724	8,023
1879.....	8,426	8,660	1899.....	8,261	8,472	1918.....	7,725	8,012
1880.....	8,990	8,906	1900.....	7,604	8,405	1919.....	8,165	7,952
1881.....	9,009	8,881						

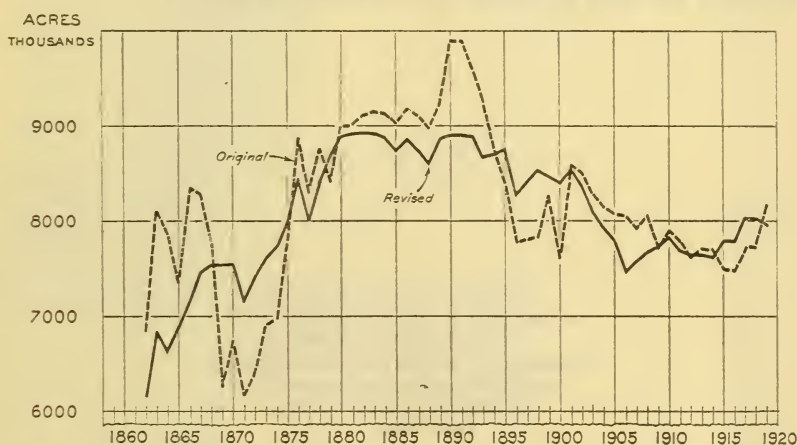


FIG. 11.—Harvested acreage of wheat, corn, oats, barley, rye, buckwheat, potatoes, tobacco, and hay, New York, original and revised estimates, 1862–1919

TOTAL OF NINE PRINCIPAL CROPS

(Table 10, fig. 11)

The effect which revisions of individual crops would have on the total has only to a slight extent been considered while this work has been in progress. Thus the "total" table and graph are the result of independent revision of each crop.

The trend of the total for the nine crops is smoothed considerably, however, by the revision. Changes in oats, and to a less extent in other crops, have modified it previous to 1875 and correction of hay figures removes the irregularities during the first years of the nineties.

The character of the line from 1895 to 1901 is changed by revisions for several crops during the period and by eliminating the change of basis between 1900 and 1901. Probably the error of the estimates in the nineties more than in any other period was due to erroneous method in general.

Change in the trend from 1914 to 1919 is due principally to revision of hay acreage, giving, as might be expected, an upward trend for total of main crop acreage due to the impetus of the period of high prices.

The revision indicates that the acreage of major crops for the State reached its high point a decade earlier than was shown by the original record. Neither series can be assumed to represent total tilled or arable acreage, however, without consideration of truck crops and small fruits, orchards, vineyards, and pasture.

Fluctuations in the acreage of individual crops has been so great that isolated study might make them seem questionable. Yet when they are aggregated the greater part of the changes is seen to have been shifts between crops, each one making inroads upon the others or receding before them as changing conditions dictated.

The shape of the revised "total" curve perhaps is little different than one should expect in New York from a general historical study of our agriculture and industry, the most noteworthy feature being the comparatively rapid rise during the first years and possibly the lateness of the time at which the crest was reached.

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